DRAFT

Indiana Science, Technology, Engineering, and Mathematics (STEM) Education

6-Year Strategic Plan

July 2018

Contents

1. Executive Summary
2. Introduction
3. State Role, Vision & Mission
4. Indiana STEM Education Belief Statement
5. Theory of Action
6. A Strategic Plan for State Investments and Coordination in STEM Education
7. A Roadmap: Implementing our 6-Year Strategic Plan
8. Monitoring and Evaluating STEM Education
9. Moving Forward: Conclusion

1. Executive Summary

[To be filled in once written]

2. Introduction

The State of Indiana has been presented an incredible opportunity to enhance the success of our students through greater exposure and learning in the STEM (science, technology, engineering, and math) disciplines. These disciplines are the building blocks of our current and future economy. In a tremendous sign of unity for our Hoosiers, STEM has been identified as a priority by Governor Eric Holcomb, Superintendent of Public Instruction Dr. Jennifer McCormick, and the Indiana State Legislature. To this end, our state legislature approved STEM Alignment Funds for the Indiana Department of Education in the 2017-2018 state budget; the first such funding in Indiana, designed to foster the development of a statewide strategy to provide consistent and equitable access to daily science, technology and engineering education in grades K-12.

A plan of this nature requires significant collaboration with several State agencies involved in education, workforce and economic development as well as state employers to ensure we prepare our students for the variety of opportunities that will be available at all levels of educational achievement. The Indiana Department of Education took immediate action with the awarded funding to develop this Strategic Plan. An Indiana state-wide STEM Advisory Council was formed to advise on the development of this Strategic Plan for STEM education in Indiana in the fall of 2017. The STEM Advisory Council met at regular intervals over the course of a year to devise and approve this strategy, implementation plan and funding recommendations in time for the 2019 budget session.

State of Indiana and the National Context

Indiana is experiencing a crisis in cultivating a highly-developed, technologically-advanced workforce and, as a consequence, is up against a rapidly growing "**STEM deficit.**" The health and longevity of Indiana's citizenry, workforce and educational advancement depends in large part on the acceleration of scientific and technological innovations, such as those that improve health care, inspire new industries, protect Hoosier natural resources and safeguard us from national harm. Maintaining Indiana's historical preeminence in our Nation's advanced manufacturing industry, as well as biomedical, agricultural and technology sectors, will require

a concerted and inclusive effort to ensure that the state's STEM workforce is equipped with the skills and training needed to excel in these fields.

Rapid technological advancements have propelled world labor markets and society from traditional industry to an innovation-based economy and, as a result, has created an environment in which all people must be "equipped with a new set of core knowledge and skills to solve difficult problems, gather and evaluate evidence, and make sense of information they receive from varied print and, increasingly, digital media" (U.S. Department of Education, 2016, p. i). These capacities can be developed through the process of learning and practicing the science, technology, engineering, and mathematics (STEM) disciplines. High-quality STEM learning experiences have been shown to foster students' abilities to work in teams, persistence in the face of challenges, and abilities to draw on gained knowledge to navigate new situations (Bailey et al., 2015; Bertrus, 2015).

Unfortunately, not all young people have access to a strong STEM education; namely, one that "starts as early as preschool, is culturally responsive, employs problem- and inquiry-based approaches, and engages students in hands-on activities that offer opportunities to interact with STEM professionals" (U.S. Department of Education, 2016, p. 1). Persistent achievement and opportunity gaps in STEM across geographic, socioeconomic, racial and ethnic, and gender lines challenge our education system and result in troubling disparities that can having lasting impact. Recent data indicate that, between 2017 and 2027, STEM jobs will grow 13 percent compared to 9 percent of all other jobs in the U.S., with jobs in the specific fields of computing, advanced manufacturing, and engineering growing by 14 percent, 12 percent, and 7 percent, respectively. In addition, STEM jobs, on average pay better. In the U.S., median earnings for STEM jobs are nearly $40/hour compared with just over $19/hour for all other jobs. Moreover, labor market data also show that traditional "non-STEM" occupations are now demanding the types of cognitive knowledge and skills associated with typically associated with a STEM educational background (Rothwell, 2013).

In the context of these data, the STEM fields are recognized as an essential component of a well-rounded education and "the gateway to America's continued economic competitiveness and national security, and the price of admission to higher education and higher standards of living for the country's historically underrepresented populations" (U.S. Department of Education, Office for Civil Rights, p. 2). Even looking beyond the next decade, when the jobs of the future are unknown, the set of mindsets, skills, and habits that are gained from learning and practicing STEM are likely to better equip our current generation of learners with and the academic tenacity and capacity for lifelong learning; thus enabling them to flexibly adapt to rapid changes in the workplace (Dweck, Walton, & Cohen, 2014).

Experts in the field of STEM education stress that, in addition to the thriving in the workplace, STEM learning supports knowledgeable civic engagement (Volmert, Baran, Kendall-Taylor, & O'Neil, 2013). STEM learning experiences that ask students to apply STEM concepts to real-world problems empowers students to be civically engaged in a complex society fraught with local, as well as global challenges. A deep foundation of STEM content knowledge along with mindsets and habits of mind that develop from applying STEM concepts and skills in engaging learning environments provides students with the ability to critically assess claims related to health, environmental, socio-economic and many other challenges they will make decisions about each day.

Research indicates that rural schools experience challenges related to geographic isolation, having fewer numbers of experienced teachers, and limited resources in their efforts to foster school improvement and promote student success (Boyer, 2006). Indeed, children in rural communities, many of whom come from lower lower-income families, often start kindergarten with lower mathematics achievement and make less progress during elementary and middle school than their suburban and urban peers (Graham & Provost, 2012). At the high school level, the data also are startling with respect to disparities in access to rigorous math and science coursework. Nationally, only half of U.S. high schools offer calculus, and only 63 percent offer physics, both of which are courses that have been identified as critical predictors of STEM achievement and postsecondary STEM success (Hinojosa, Rapaport, Jaciw, LiCalsi, & Zacamy, 2016; Borman, Margolin, Garland, Rapaport, Park, S., & LiCalsi, 2017). Even more concerning, at least 10-25 percent of high schools offer Algebra I and II, geometry, biology, and chemistry—typically considered the core set of math and science courses for students in grades 9-12 (U.S. Department of Education, Office for Civil Rights, 2014). Consistent with achievement trends in these subject areas, White and Asian students are more likely to attend schools that have the full range of mathematics and science courses, compared with their underrepresented minority peers (U.S. Department of Education, Office for Civil Rights, 2014).

<u>How We Will Close the Deficit</u>

The Indiana STEM Advisory Council, chaired by the Department of Education, developed this 6-Year State Science, Technology, Engineering, and Mathematics (STEM) Education Strategic Plan in response to the urgency of implementing a **whole of systems approach** to tackle our STEM deficit. This plan sets forth a strong foundation for a state approach to accelerate STEM education, careers, workforce training and critical thinking across Indiana to meet the demand of a highly-trained, technologically-advanced economy through education advancement. By, first, strategically focusing on and sourcing the Indiana Department of Education, the State will

make significant gains in K-12 learning environments to better prepare rising generations of students and future Hoosier workers.

Now is a time of urgency and opportunity – that we can build a true "all hands on deck" effort to move Indiana forward and address this challenge. Setting forth a strong foundation for, first, a whole of government approach, driving us towards a whole of systems operational structure, will require investments to fully source the following government agencies to tackle our STEM deficit:

- **Department of Education: Prioritizing STEM for the Administration's education efforts.**

- **Commission for Higher Education: Setting ambitious but achievable goals for Indiana's postsecondary institutions**.

- **Department of Workforce Development: Investing in and better training the future STEM workforce pipeline.**

With these agencies working in concert, this Strategic Plan will allow us to better achieve a number of interrelated goals:

- It will help state STEM efforts reach more students and teachers more effectively by reorienting state policy to meet the needs of those who are delivering STEM education statewide: school districts, State agencies, non-profit organizations, private sector, and colleges and universities;

- It will help in organizing efforts and redirecting resources around more clearly defined priorities, with accountable lead government agencies;

- It will enable rigorous evaluation and evidence-based strategies for designing State-funded STEM-education programs;

- It will increase the impact of State investments in important areas, such as elementary education, by expanding resources for a more limited number of defined programs, while recognizing shortages in key disciplines and professions; and,

- It will provide additional resources to meet specific goals, such as preparing all of Indiana's K-12 teachers with STEM pedagogy, recognizing and rewarding excellence in

STEM instruction, strengthening the infrastructure for supporting evidence-based STEM curriculum, foster early career exposure in Hoosier communities.

- State legislature and leadership will be critical to our continued and collective effort on securing Indiana's position at the forefront of our Nation's STEM innovation and discovery.

3. State Role, Vision and Mission

To date, State agencies with a focus on education or workforce, specifically the Department of Education (DOE), Commission for Higher Education (CHE) and the Department of Workforce Development (DWD), have programs or objectives to support STEM learning, but have not, traditionally, coordinated in a purposeful manner supported by a strategy. Until the state legislature approved $2 million in STEM Alignment Funds for the Indiana Department of Education in the 2017-2018 budget, the only direct STEM funding in the state was in the form of $10 million biannually provided to the CHE to further STEM teaching in Indiana, with grants provided on a competitive basis from the funds. The DOE has spearheaded a STEM school certification program though no funding is attached. In its 4 years of awarding certifications, 60 schools have been certified STEM schools. STEM is embedded in many Career Technical Education (CTE) pathways, disciplines are present and hands on activities exist - but STEM pedagogy is not comprehensively or intentionally practiced in a large majority of CTE classrooms. DOE has gathered and promoted strong tools from leading national and state STEM organizations around best practices in STEM programming, but it has not had a strategy inclusive of other State actors involved in STEM activities. The DWD has utilized its Skill-Up grants to foster growth in part in STEM fields of employment.

In an effort to take a lead in coordinating across government agencies and external STEM stakeholders, DOE made sure to include the aforementioned agencies on the Indiana STEM Advisory Council to define a cohesive vision, mission and strategy together.

This Strategic Plan supports the **vision** of the Indiana STEM Advisory Council. Our coordinated effort will lay the foundation for a future where:

All Indiana students in grades K-12 will graduate with critical thinking skills and be prepared for an innovation-driven economy by accessing quality, world class STEM education every day in the classroom by 2025.

Achieving our vision will require a strong commitment to coordinating and reorienting our resources across the state to implement our **mission** to*:*

Ensure Hoosier teachers are prepared to provide every student in grades K-12 with an evidence-based, effective STEM education by 2025.

If we are able to achieve our intended outcomes in this Strategic Plan, driven by our vision and executing our mission, Indiana students will be better prepared for global competitiveness, develop into a STEM-literate population and ensure the longevity of a highly qualified, Hoosier workforce.

State agencies, postsecondary institutions, businesses and philanthropists represented on our STEM Advisory Council will be critical to leverage and coordinate aforementioned resources to make significant state gains, both in and outside the public sector systems. All of the Council members support STEM education, either directly or indirectly, and their continuous involvement in the implementation of this plan will be critical to our success and achieving our ambitious goals.

The Indiana STEM Advisory Council would like to also call out the importance of working with external organizations and non-State partners to achieve success. To effectively leverage its investments, the State must coordinate its efforts strategically and collaboratively with non-State partners to support institutional, state, and local efforts. Local school districts, institutions of higher education, professional and scientific societies, philanthropic and corporate foundations, botanical gardens, museums, science centers, afterschool providers, and private industry, for example, play significant roles in growing our state's STEM education pipeline and creating pathways to STEM. Each stakeholder brings a set of resources and expertise that are necessary for Indiana's STEM education systems to reach their full potential. The State government will work closely with these stakeholders to identify common areas of concern and to collaborate on strategies within this Strategic Plan.

4. Indiana STEM Education Belief Statement

In order to achieve our intended outcomes in this plan, all coordinated State actors must work from the same definition of STEM. The State of Indiana believes STEM is:

STEM education is the integration of the Science, Technology, Engineering and Math disciplines with the goal of deploying critical-thinking, problem-based, minds-on approaches

to learning in the classroom and creating pathways to career and postsecondary readiness. STEM education supports the maturation of students with life skills and mindsets for lifelong learning and success in the workplace.

> The United States has developed as a global leader, in large part, through the genius and hard work of its scientists, engineers, and innovators. In a world that's becoming increasingly complex, where success is driven not only by *what* you know, but by what you *can do* with what you know, it's more important than ever for our youth to be equipped with the knowledge and skills to solve tough problems, gather and evaluate evidence, and make sense of information. These are the types of skills that students learn by studying science, technology, engineering, and math—subjects collectively known as STEM. – U.S. Department of Education

> STEM education is an intentional, metadisciplinary approach to teaching and learning, in which students uncover and acquire a cohesive set of concepts, competencies, and dispositions of science, technology, engineering, and mathematics that they transfer and apply in both academic and real-world contexts, in order to be globally competitive in the 21st Century. -Rider-Bertrand 2007

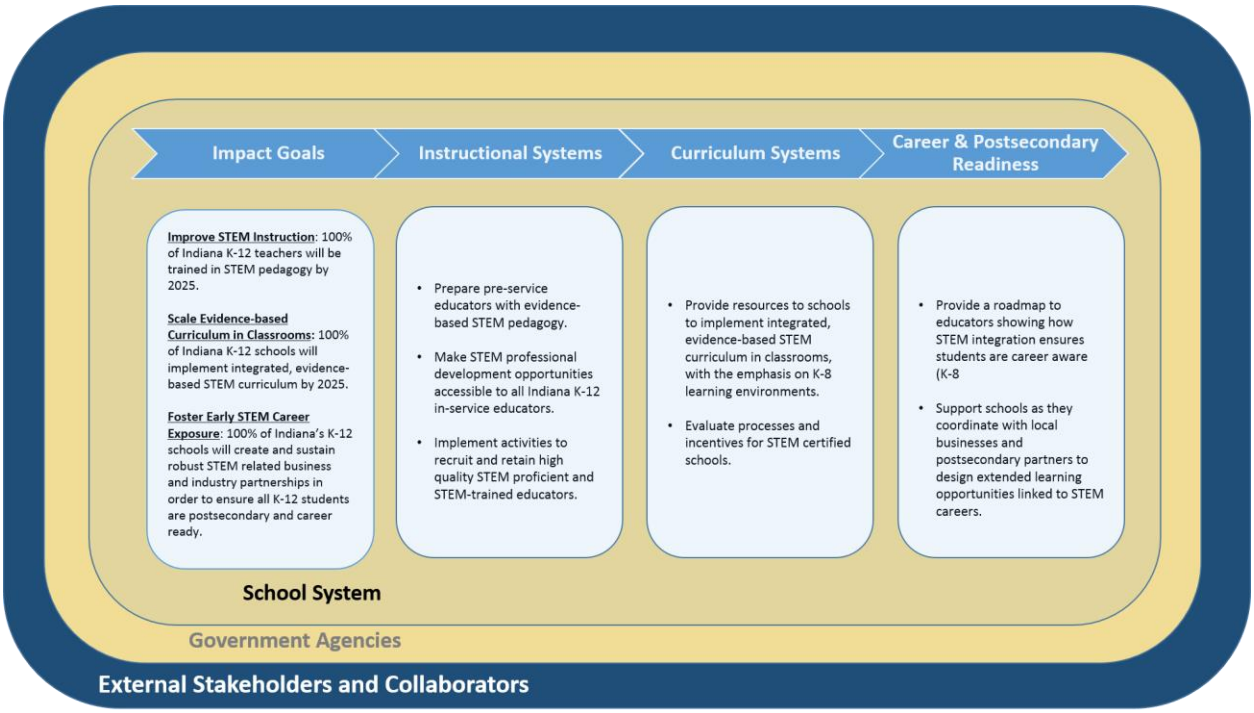
5. Theory of Action

A Theory of Action (TOA) will guide our Strategic Plan into actionable steps over the next six years:

> To close the STEM deficit in Indiana, the State will focus on effectively resourcing K-12 learning environments, ensuring Hoosier teachers are prepared to provide every student in these grades with an evidence-based, effective STEM education by 2025. By focusing on three strategic objectives within the K-12 system, we will achieve significant gains for Indiana's workforce and academic achievement. These three strategic objectives include: 1) Improve STEM **instruction** across the state; 2) Implement evidence-based, vetted STEM **curriculum** in all schools; 3) Foster early exposure to STEM **careers** in Hoosier communities.

Quantitative and qualitative goals frame the expected and measurable outcomes introduced in this Strategic Plan to achieve a whole-systems transformation across the State.

We will also focus on **a dual whole of systems coordination approaches** overlaying our strategy and implementation plan: 1) Build new interagency partnerships for leveraging assets and expertise; 2) Build and use evidence-based research to drive STEM program design decision-making across agencies.



6. A Strategic Plan for State Investments and Coordination in STEM Education

Many of the Indiana State agencies have placed a high priority on STEM education and have developed education initiatives unique to their agency's mission, needs, and resources. To better leverage these assets and expertise, this Strategic Plan, the result of extensive cross-agency, cross-sector collaboration, articulates a strategy for making progress on this statewide priority. Through identified agencies, the State of Indiana is committed to laying groundwork that will set the course for a coherent and impactful collective State STEM education investment for the next six years.

The plan presents three strategic objectives where a coordinated State implementation plan will be developed, over six years, designed to lead to major improvements in key educational areas and drive our mission.

Under the direction of the Indiana Department of Education and in partnership with the Indiana STEM Advisory Council, the following objectives and recommendations have been developed to address the full integration of STEM education in K-12 learning. High level impact goals will drive the implementation of our recommendations to achieve strategic objectives:

- Improve STEM Instruction: 100% of Indiana K-12 teachers will be trained in STEM pedagogy by 2025.
- Scale Evidence-based Curriculum in Classrooms**:** 100% of Indiana K-12 schools will implement integrated, evidence-based STEM curriculum by 2025.
- Foster Early STEM Career Exposure: 100% of Indiana's K-12 schools will create and sustain robust STEM related business and industry partnerships in order to ensure all K-12 students are postsecondary and career ready.

STEM education coordination approaches is central to the success of this Strategic Plan. By designating initial lead and collaborating agencies in the priority STEM education investment areas (our strategic objectives), the Strategic Plan encourages a more deliberative focus among new and existing efforts, the expansion of existing collaborations, and the creation of new synergies.

To do so, State agencies will focus on two main STEM education coordination approaches (as reflected in the TOA):

- Build new models for leveraging assets and expertise. Implement a strategy of lead and collaborating agencies to leverage capabilities across agencies to achieve the most significant impact of State STEM education investments.

- Build and use evidence-based approaches. Conduct STEM education research and evaluation to build evidence about promising practices and program effectiveness, to be used across agencies.

7. A Roadmap: Implementing a 6-Yr State STEM Education Strategic Plan

For each of the three strategic objectives, a set of recommendations have been identified as the focus for initial implementation of the Strategic Plan. These recommendations have been developed with several considerations: they strive to be specific for school districts, so that progress and impact can be measured; they are meant to align with the strengths and assets of the designated lead agency and to allow for the significant role of collaborating agencies and external actors; and they represent areas where there is a clear responsibility for involvement of the State government (IDOE, CHE and DWD), with the realization that State investment will play only a part in achieving the intended impact. These have been deemed as "recommendations" as they are just that - a recommended roadmap for agencies and schools districts to follow while implementing STEM programming and State-funded initiatives.

Strategic Objective 1: Improve STEM Instruction

Impact Goal: 100% of Indiana K-12 teachers will be trained in STEM pedagogy by 2025.

Purpose**:**
The development of STEM educators is multifaceted and involves both pre-service preparation and continuing in-service professional development opportunities that span the life of their careers. Comprehensive training in STEM pedagogy is an essential component to deepening the understanding and abilities of educators. STEM pedagogy may include a combination of any of the following: problem or project based learning, design-based thinking, inquiry-based learning with the infusion of a focus on important 21st Century Skills within the context of real-world challenges and dilemmas that build critical thinking and problem solving skills.

> **STEM pedagogy** can include the use of any one or more of the following: problem or project based learning, design-based thinking, inquiry-based learning with the infusion of a focus on important 21st Century Skills within the context of real-world challenges and dilemmas.
> -Dr. Carla Johnson, Purdue University

The recruitment, training, and retention of STEM educators should be approached through a holistic and collaborative strategy that involves both school, district and state level resources and professional supports, meaningful community-based engagement and initiatives, as well as expansive opportunities for educators to gain hands on STEM experiences while participating in authentic statewide STEM research. High quality STEM educators will recognize effective STEM instruction and have the internal capacity to develop Indiana students into inquisitive, problem solving, critical- thinkers who grow an inspired interest in STEM subjects. Indiana State government and supporting State agencies play a vital role in providing resources and supports needed in order to recruit, develop, and retain a top-notch STEM educational workforce that will educate Indiana youth in a way that will prepare them for our future.

Implementation Roadmap:

Recommendation 1: Prepare pre-service educators with evidence-based STEM pedagogy

Actions	Outcomes	Metric/Milestones	Collaborators (System Actors)

Near-term (years 1-3):			
Embed evidence-based, STEM pedagogy and instructional practices into all Indiana educator prep programs.	STEM pedagogy is embedded within all Indiana pre-service educator prep programs which will prepare pre-service educators to embed STEM pedagogical components into their classrooms. Novice educators are better prepared to integrate evidence-based STEM pedagogy and instructional practices into all Indiana classrooms.	Growth will be shown in the total number of existing pre-service educator prep programs that integrate evidence-based STEM pedagogy and instructional practices into their pre-service educator prep programs. By 2021, 50% of educators entering the profession will be proficient in STEM pedagogy and instructional practices.	
Long-term (years 4-6):	All novice educators are better prepared to integrate evidence-based STEM pedagogy and instructional practices into all Indiana classrooms.	By 2023, 75% of educators entering the profession will be proficient in STEM pedagogy and instructional practices.	

		By 2025, 100% of educators entering the profession will be proficient in STEM pedagogy and instructional practices.	

Recommendation 2: Make STEM professional development opportunities accessible to all Indiana K-12 in-service educators.

Actions	Outcomes	Metric/Milestones	Collaborators (System Actors)
Near-term (years 1-3):			
Identify and provide funding for evidence-based, highly qualified providers of STEM PD opportunities for in-service educators, both content specific and non-content specific.	School districts will have access to a vetted list and funding for high quality, evidence based STEM PD.	Growth will be shown in the total number of existing in-service educators that are trained in vetted STEM PD. By 2021, 50% of in-service educators will be trained in vetted STEM PD.	
Long-term (years 4-6):		By 2023, 75% of educators entering the profession will be proficient in STEM pedagogy and	

		instructional practices.	
Implement a system of periodic reviews of state STEM-related professional development practices, monitor effectiveness, and use research findings to inform necessary adjustments	School districts will continue to have access to a vetted list and funding for high quality, evidence based STEM PD, with adjustments made from research findings.	By 2025, 100% of all K-5 Indiana in-service teachers will be trained by vetted STEM providers.	

Recommendation 3: Implement activities to recruit and retain high quality STEM proficient and STEM-trained educators.

Actions	Outcomes	Metric/Milestones	Collaborators (System Actors)
Near-term (1-3):			
Develop strategies to recruit teachers and administrators in STEM disciplines.	A larger pool of highly qualified STEM candidates will enter the field of education.	Growth in the number of teachers and administrators entering K-12 education By 2021, 50% increase in the number of educators entering the field in a STEM related discipline.	

Develop STEM cadre to foster STEM teacher and STEM administrator collaboration and sharing of best practices across the State.	STEM cadre development		
Long-term (4-6):			
Identify, support, and fund summer externships opportunities for educators through temporary summer positions in local STEM related businesses and industry.	Externships will benefit teacher-real world applications to the classroom.	By 2023, 75% increase in the number of educators entering the field in a STEM related discipline. Survey taken after each externship to determine value. 50 teachers the first year and then 100 teachers each year/summer.	

Strategic Objective 2: Scale Evidence-based STEM Curriculum in Classrooms

Impact Goal: 100% of Indiana schools will implement integrated, evidence-based STEM curriculum by 2025.

Purpose:

An investment in integrated, standards based, inquiry-based, real world problem-solving STEM curriculum and supportive professional development is critical in creating a learning environment of rigor, curiosity, and academic achievement. The research base to support learner-centered instruction is identified in How People Learn (Donovan & Bransford, 2005), which outlines that a metacognitive approach to instruction can help students learn to take control of their own learning by defining learning goals and monitoring their progress in achieving them. This research is reflected in the work of the Committee on Highly Successful Schools or Programs for K-12 STEM Education as part of the National Research Council that recognized the strong evidence base for STEM instruction and school-level practices. Research in STEM teaching and learning over the past two decades characterizes effective STEM education instruction that capitalizes on students' early interest and experiences, identifies and builds on what they know, and provides them with experiences to engage them in the practices of the disciplines to sustain their interest.

Implementation Roadmap:

Recommendation 1: Provide resources to schools to implement integrated, evidence-based STEM curriculum in classrooms, with the emphasis on K-8 learning environments.

Actions	Outcomes	Metric/Milestones	Collaborators (System Actors)
Short-term (years 1-3):			
Survey schools to intake type of curriculum being used	Knowledge of curricula being used across the state for others to see it in action	Provide data on number of schools utilizing evidence-based curriculum	

Provide funding opportunities for schools to implement evidence-based STEM curriculum	Quality curriculum implemented in districts	Data on how many schools are using evidence based curriculum across the state	
Long-term (years 4-6):			
(Short term) Identify and publish a list of evidence-based STEM curriculum providers	A list of evidence-based curriculum will be published by IDOE	Provide data on curriculum impact	
(Short term) Crosswalk curriculum to IN state standards	Crosswalked, evidence-based curriculum will be published by IDOE	Provide data on curriculum impact	

Recommendation 2: Evaluate processes and incentives for STEM certified schools.

Actions	Outcomes	Metric/Milestones	Collaborators (System Actors)
Short-term (years 1-3):			

Reevaluate the IDOE STEM Certification process with the goal of deciding if or how it will continue under new strategic plan	A recommendation on continuing a STEM Certification process in Indiana	1) Create a STEM school designation subcommittee from the IDOE STEM Council consisting of effective STEM school leaders and representatives from across the state to engage in STEM Certification approvals by 2019-2020. 2) Make recommendation by 2019-2020.	
Long-term (years 4-6):			
To be determined based on evaluation of STEM Certification process			

Strategic Objective 3: Foster Early STEM Career Exposure

Impact Goal**:** 100% of Indiana schools will create and sustain robust STEM related business and industry partnerships in order to inform curriculum, instruction, and student experiences.

Purpose:
STEM Education is critical for preparing students for postsecondary and career success. The National STEM Coalition shares important statistics:

- One job in the high-tech sector leads to 4.3 jobs in local goods and services industries – which results in positive ripple effects across the entire economy.
- Between 2014 and 2024, the number of STEM jobs will grow 17 percent, as compared to 12 percent for non-STEM jobs.
- At all levels of educational attainment, STEM job holders earn 11 percent higher wages compared to their same-degree counterparts in other jobs.
- Almost all of the 30 fastest-growing occupations in the next decade will require at least some background in STEM.

On one of the most important points in the new NGSS standards, the math and science efforts are in agreement: Content mastery alone is not sufficient for success. The demands of 21st century higher education and the 21st century workplace require "21st century skills." The ability to memorize facts and procedures – the areas most commonly tested in previous state accountability systems – will be non-applicable without the ability to apply knowledge and skills within and across disciplines.

Essential to ensuring students are career aware (K-8) and career ready (9-12) is access to rigorous, relevant STEM-related experiences outside of the classroom. From robotics competitions to internship experiences, an intentional effort to connect students to careers and industry professionals ignites passion and increases hope.

Implementation Roadmap**:**

Recommendation 1: Provide a roadmap to educators showing how STEM integration ensures students are career aware (K-8) and career ready (9-12).

Actions	Outcomes	Metric/Milestones	Agency Collaborators

Short-term (years 1-3):			
Support schools in developing age-appropriate STEM experiences	Development of a comprehensive playbook outlining best practices in STEM integration	By 2019, establish a baseline of STEM-focused partnerships By 2020, STEM-focused partnerships increased by 10% By 2021 STEM-focused partnerships increased by 25%	
	Crosswalk of STEM-related experiences and courses to graduation pathways	By 2019, baseline perception data By 2020, Increase in school comfort level and understanding of STEM-related experiences linked to graduation pathways. -Increase in overall understanding of STEM integration (perception data)	

Enhance existing partnerships and develop new partnerships with business and postsecondary to create appropriate STEM graduation pathways	Development of new innovative Locally Created Pathways (LCPs) linked to STEM	By 2019, baseline of number of STEM-related LCPs By 2020, Increase in number of STEM-related LCPs by 5% By 2021, Increase in number of STEM-related LCPs by 5%	

Recommendation 2: Support schools as they coordinate with local businesses and postsecondary partners to design extended learning opportunities linked to STEM careers.

Actions	Outcomes	Metric/Milestones	Agency Collaborators
Short-term (years 1-3):			
Support schools and students in the graduation pathways areas of work based learning (WBL)	Establish collaborative (education, business, and civic) to scale and streamline student and school access to high-wage, high-demand careers and experiences	10% of cohort 2021 will engage in STEM-related WBL experiences through the Indiana Workforce Collaborative 25% of cohort 2023 will engage in STEM-related WBL experiences through the Indiana Workforce Collaborative	

Support business and postsecondary partnership development	Establish development cycle to monitor and support school to business (and school to postsecondary institution) STEM-focused partnerships	By 2019, establish a baseline of STEM-focused partnerships By 2020, STEM-focused partnerships increased by 10% By 2021 STEM-focused partnerships increased by 25%	
Promote and highlight innovative STEM business and postsecondary partnerships	Establish Statewide recognition of best practices in STEM partnerships	By 2019, establish a baseline of STEM-focused partnerships By 2020, STEM-focused partnerships increased by 10% By 2021 STEM-focused partnerships increased by 25%	
Collaborate with organizations to promote STEM experiences outside of the classroom (K-8)	Increase career awareness for students in grades K-8	By 2021, provide data on STEM experiences in grades K-8	
Long-term (years 4-6):			
Evaluate success of Indiana Workforce Collaborative	Selection of external evaluator	Metrics determined by evaluator	

8. Monitoring and Evaluating STEM Education

The evaluation and monitoring of STEM programming allows the Department of Education, Indiana STEM Advisory Council and State Legislatures to better understand the impact of how exemplary STEM programs are contributing to the growth of Indiana's students. Without data, it is nearly impossible to effectively make policy or deploy State funding. For example, the evaluation will include a survey of educators who implement State STEM grants and funding assess the State's ROI (Return On Investment) and potential for impact to scale. Our goal is that Hoosiers come to trust and depend on the independent assessment of State STEM resources to develop our students as critical-thinkers and grow the State's workforce talent.

There is a strong interest across the government and outside collaborators in using evidence in policy and management decisions in all arenas, including STEM education, to increase the impact and efficiency of STEM programs. Given the important role of data and evaluations, State STEM education investments will increase use of research studies and program evaluation to identify and test practices and approaches for their effectiveness, thus building the evidence base for improving statewide STEM education investments. As appropriate, programs will rest on or scale up evidence-based practices.

9. Conclusion: Moving Forward

Through the adoption of this Strategic Plan, Indiana will be ready to lead the nation in STEM instruction, curriculum implementation and early STEM career exposure (for students and teachers) to ensure a strengthened U.S. position in the global economy. This collaborative, statewide approach will help shape and strengthen Indiana's future both academically and economically. By implementing a fully integrated K-12 STEM education system, we will build sustainable, equitable opportunities for every child in Indiana.

References

http://vitalsigns.ecs.org/state/United-States/demand
http://vitalsigns.ecs.org/state/United-States/demand
U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2017 Mathematics Assessment.
U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2015 Science Assessment
U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2017 Mathematics Assessments
U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2015 Science Assessments.
U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2015 Science Assessments.
U.S. Department of Education, Office for Civil Rights, Civil Rights data collection, 2013-14 State and National Estimations.
https://ocrdata.ed.gov/StateNationalEstimations/Estimations_2013_14
U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2015 Science Assessment.
U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, Integrated Postsecondary Education Data System (IPEDS), Fall 2001 through Fall 2015 Completions component.